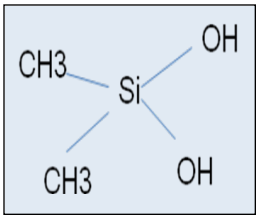
Analytical "Innovation" within the SF Water and Food Analytical Laboratory (WAFAL)



SF WAFAL: alphabetically, Jim Alverson, Mickie Benoit, Lydia Ding, Dan Gazda, Marie Hwang, Sharon Jackson, Mike Kuo, Esther Liu, Torin McCoy, Debbie Plumlee, Jeff Rutz, John Schultz, John Straub, Dawn Zapp

Imagine for a moment that you are a water quality expert facing the following scientific dilemma. You have been observing an increasing trend in total organic carbon (TOC) during in-flight monitoring of water from the U.S. Water Processor Assembly on ISS. Unfortunately, compound identification is not possible with the in-flight TOC screening. Long-awaited archive water samples return from ISS, and all eyes are on your laboratory to announce the compound's identity so that risk assessment and system troubleshooting can occur. After an intensive week of analysis you find...nothing. You can almost hear the crickets chirp as expectant eyes scan the analytical tables looking for the "smoking gun". The unspoken words "What Do We Do Now?", pass through everyone's minds.

This scenario was reality for the SF/Water and Food Analytical (WAFAL) laboratory this Fall. The response that occurred to this challenge was a testament to the importance of teamwork, innovative thought, and old-fashioned scientific detective work.

Senior WAFAL chemist Jeff Rutz and Quality Assurance Coordinator Debbie Plumlee had noted unidentified peaks in the ISS water samples that they thought might represent a significant organic unknown. After some optimization work, WAFAL strategically called together experts to brainstorm on this analytical "signature", and an identity was suggested by one of the participants (Dr. Harold Cole/Boeing); an organic silicon compound called dimethylsilanediol (DMSD). But this remained a theory, and some strong analytical proof was still needed. Dr. Mike Kuo proposed a separate analytical approach to characterize overall silicon in the water samples. While not specific to DMSD, data from this practical approach displayed a consistent trend with the suspect peaks, suggesting that the mystery compound was silicon-based.

Despite this finding, an established laboratory standard for DMSD was still needed to confirm the identity of the compound and determine concentrations. A huge hurdle was encountered when no commercial source of DMSD standard could be located. With some helpful leads from Dr. Tom Limero in the SF Toxicology Lab, WAFAL developed a method to synthesize DMSD on their own. This approach was non-traditional, and carried extra uncertainties that had to be carefully addressed. For example, Dr. John Schultz and colleagues came up with a way to determine the yield of the DMSD synthesis method by assessing other chemical indicators as quantifiable reaction byproducts.

Thanks to this tremendous collective effort and creative thought (both inside and outside of WAFAL), DMSD was confirmed in the ISS water samples, and concentration estimates were recently released to stakeholders. Although not an immediate crew health concern at current levels on ISS, there are intensive ongoing efforts to identify the root cause of the DMSD rise. While the rest of the story is still unfolding, WAFAL data has helped lay the foundation for resolution of this anomaly; a foundation enabled by innovative thought from dedicated professionals working together as a team.